

REMARKS

Claims 1-8, 12-14, 17, 18 and 25-26 remain pending in this application. Claims 25 and 26 have been withdrawn from consideration. Claim 9 has been cancelled herein. Claims 1-8, 12-14, 17, 18 are under consideration.

Claims 1, 3, 5, 8, and 14 have been amended herein. Support for the amendments can be found in the specification. No new matter has been added. The amendments made herein are made for purposes of clarification or consistency throughout, do not narrow the claims, and are not for reasons substantially related to patentability.

Formalities:

Applicant notes the Office Action required the correction of the typographical error in claim 14 with respect to the genus *Arabidopsis*, and the same has been made.

The claims, as amended, satisfy the definiteness requirement of 35 U.S.C. §112, second paragraph:

Claims 1-9, 12-14 and 17-18 stand rejected under 35 U.S.C. §112, second paragraph as allegedly indefinite. Applicant asserts that the claims as amended are definite with respect to what applicant regards as his invention.

Claims 1, 3, and 4 were deemed indefinite for the recitation of "gene." Applicant's amended claim 1 recites "sequence of a gene. . ." The Office Action notes the word implies DNA in nature including coding and noncoding regions. Applicant asserts that an isolated nucleic acid comprising the sequence of a gene as claimed is definite with respect to the sequence claimed. Accordingly, Applicant requests withdrawal of the rejection.

Claim 1 was deemed indefinite for the recitation of "disruption of which." The Office Action alleged that it was unclear as to whether the gene or the chromosome was disrupted. Applicant asserts that the claim as amended is clear with respect to the disruption being of said gene, thus the claim is definite with respect to the term "disruption". Applicant respectfully requests withdrawal of the rejection.

Claim 1 was deemed indefinite for the recitation "associated with" as it was allegedly unclear in which way the disruption was associated with the function. The claim as amended no longer recites "associated with." Thus the grounds for the objection are obviated and Applicant therefore requests withdrawal of the rejection.

Claim 1 was deemed indefinite for the recitation of "homolog," and Applicant asserts that the term as used in the claim was definite to one of skill in art, particularly in view of the specification; however to advance prosecution Applicant has amended to the requested homonym "homologous chromosome." Accordingly, Applicant requests withdrawal of the rejection.

Applicant asserts that claim 1, as amended, is definite with respect to each term and that the grounds for the above-identified rejections have been removed. For these reasons, Applicant requests withdrawal of the rejections under 35 U.S.C. §112, second paragraph. The Applicant further notes that these amendments, while advancing prosecution, in no way narrow the scope of the claimed invention.

Claim 3 was deemed indefinite for the recitation of the term "approximately." Applicants respectfully traverse this rejection. Much like the term "substantially," "approximately" can be considered a definite term used to "avoid a strict numerical boundary to the specified parameter". The Federal Circuit recently stated:

"Patent documents are written for persons familiar with the relevant field; the patentee is not required to include in the specification information readily understood by practitioners, lest every patent be required to be written as a comprehensive tutorial and treatise for the generalist, instead of a concise statement for persons in the field The question is not whether the word "substantially" has a fixed meaning . . . but how the phrase would be understood by persons experienced in this field . . . upon reading the patent documents.... Expressions such as "substantially" are used in patent

documents when warranted by the nature of the invention, in order to accommodate the minor variations that may be appropriate to secure the invention. Such usage may well satisfy the charge to "particularly point out and distinctly claim" the invention, 35 U.S.C. §112, and indeed may be necessary in order to provide the inventor with the benefit of his invention. In *Andrew Corp. v. Gabriel Elecs. Inc.*, 847 F.2d 819, 821-22, 6 USPQ2d 2010, 2013 (Fed. Cir. 1988) the court explained that usages such as "substantially equal" and "closely approximate" may serve to describe the invention with precision appropriate to the technology and without intruding on the prior art. The court again explained in *Ecolab Inc. v. Envirochem, Inc.*, 264 F.3d 1358, 1367, 60 USPQ2d 1173, 1179 (Fed. Cir. 2001) that "like the term 'about,' the term 'substantially' is a descriptive term commonly used in patent claims to 'avoid a strict numerical boundary to the specified parameter,'" quoting *Pall Corp. v. Micron Separations, Inc.*, 66 F.3d 1211, 1217, 36 USPQ2d 1225, 1229 (Fed. Cir. 1995).

The term "approximately" is a term commonly used in patents issued by the USPTO, including biotechnology patents. Recently issued U.S. patents which include claims with the term "approximately" include, for example, U.S. Patent No. 6,495,320 (reciting in claims 1 and 5 "approximately equal length [single stranded DNA] fragments"); U.S. Patent No. 6,491, 920 (reciting in claims 27 and 28 "plasmid having a molecular length of approximately x kb"); U.S. Patent No. 6,506,892 (reciting in claims 1 and 14 a "protein of molecular weight of approximately x kD") and finally U.S. Patent No. 6, 489,608 (reciting a method wherein the discreet number of trial sequences of amino acids "is limited to approximately 100").

Applicant notes that in the instant specification, at page 2, lines 21-24, it is stated that "[I]n a preferred embodiment, the gene encodes a protein with a cyclin or cyclin-like domain. In a more preferred embodiment, the gene contains exons that encode a protein that is 500-600 amino acids in length, preferably approximately 578 amino acids in length." Thus, one of skill in the art has sufficient guidance as to the metes and bounds of the applicant's claimed invention. Accordingly, Applicant requests reconsideration and withdrawal of the rejection.

Claims 5 and 14 were deemed indefinite for the recitation of "the cyclin domain of SEQ ID NO:2." The claims, as amended, reflect the location of the amino acids corresponding to the cyclin domain in accordance with the recommendations in the Office Action. Support for this amendment comes from Figure 1 and from the specification at page 3, line 28-29 stating that the cyclin domain is denoted by

underlining. The grounds of the rejection have therefore been obviated, accordingly the Applicant requests the rejection be withdrawn.

Claim 8 was deemed indefinite in the recitation of the phrase "comprises an open reading frame having the sequence set forth in SEQ ID NO:1" because the number of nucleotides in SEQ ID NO:1 allegedly did not correspond to the number of amino acids. While the Applicant asserts that those of skill in the art would understand the claim's plain meaning with respect to the "open reading frame" of SEQ ID NO:1, to facilitate prosecution, the Applicant has amended the claim to recite that the claimed sequence comprises the open reading frame having the sequence of the exons of SEQ ID NO:1. This recitation clarifies the obvious and removes the grounds of the rejection, accordingly the Applicant requests the withdrawal of the rejection as to Claim 8.

Claim 14 was deemed indefinite for the recitation of "the open reading frame having a sequence selected from the group consisting of: a) SEQ ID NO:1." The Office Action alleged that the claim was indefinite because of the lengths of the molecule claimed versus SEQ ID NO:1. As with the rejection *infra* of claim 8 with respect to 35 U.S.C. §112, second paragraph, Applicant asserts that the claim, as written, is definite to one of skill in the art; however, in order to advance prosecution, the claim has been amended to recite that the claimed sequence comprises the open reading frame having the sequence of the exons of SEQ ID NO:1. In view of the amendment, the grounds for the rejection are obviated, accordingly the Applicant requests the withdrawal of the rejection as to Claim 14.

The Requirements of 35 U.S.C. §112, First Paragraph, For Written Description Are Satisfied For Claims 1-4, 9, and 12-13.

Claims 1-4, 9 and 12-13 stand rejected under 35 U.S.C. §112, first paragraph as allegedly containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the art that the inventor was in possession of the claimed invention at the time of filing. Applicants respectfully assert that the claims as amended satisfy the requirements of the statute.

The adequacy of a written description is a question of fact which must be determined on a case-by case basis. MPEP 2163. A written description is given a strong presumption of adequacy and rejection of original claims for lack of written description should be rare. Id. An examiner must overcome the presumption of adequacy by putting forth, on a reasonable basis, sufficient evidence or reasoning. In re Wertheim, 541 F.2d 257, 263 (CCPA 1976). Arguing lack of literal support is not enough since the invention need not be described in *ipsis verbis* to satisfy the written description requirement. Id. at 265.

As the Federal Circuit has stated: “. . .the applicant must also convey with reasonable clarity to those skilled in the art that, as of the filing date sought, he or she was in possession of *the invention*. The invention is, for purposes of the ‘written description’ inquiry, *whatever is now claimed*.” Vas-Cath Inc. et al. v. Mahurkar et al., 935 F.2d 1555, 1563-4 (Fed. Cir. 1991) (emphasis in original). See also Regents of the Univ. of Cal. v. Eli Lilly & Co., 119 F.3d 1559, 1566 (Fed. Cir. 1997). A preponderance of evidence is required as to why a skilled artisan would not recognize a description of the claimed invention, as that is the perspective from which satisfaction of the requirement is measured. Amgen Inc. v. Hoechst Marion Roussel, Inc. et al., No. 01-1191, 01-1218, 2003 U.S. App. LEXIS 118 at *35 (Fed. Cir. 2003) citing Lockwood v. Am. Airlines, Inc., 107 F.3d 1565, 1572 (Fed. Cir. 1997); see also MPEP 2163.

Possession of the invention may be established through words, structures, figures, diagrams and formulas which fully set forth the claimed invention. Lockwood, 107 F.3d at 1572. “Generally there is an inverse correlation between the level of skill and knowledge in the art and the specificity of the disclosure necessary to satisfy the written description requirement.” MPEP 2163.

Most recently, the Federal Circuit stated that the purpose of the written description is “to prevent an applicant from later asserting that he invented that which he did not” by requiring him to “recount his invention in such detail that his future claims can be determined to be encompassed within his original creation.” Amgen, 2003 U.S. App. LEXIS 118 at *?? (quoting Vas-Cath, 935 F.2d at 1563). The court went on to explain that “in Enzo Biochem, we clarified that Eli Lilly did not hold that

all functional descriptions of genetic material necessarily fail as a matter of law to meet the written description requirement; rather the requirement may be satisfied if in the knowledge of the art the disclosed function is sufficiently correlated to a particular, known structure." Id. at ??

Applicant notes that the Office Action states that the claims are drawn to an isolated nucleic acid molecule comprising a gene located on *Arabidopsis thaliana* chromosome 1, the disruption of which is associated with a failure to maintain homolog attachment during meiotic prophase I, said nucleic acid molecule encoding a protein having a cyclin domain and being composed of exons that form an open reading frame having a sequence that encodes a polypeptide approximately 578 amino acids in length. Claims are also drawn to cDNA molecules comprising said exons, an oligonucleotide, a vector and a transformed plant cell.

The Office Action alleges that although the specification asserts that the polypeptide of SEQ ID NO:2 is a new type of cyclin, that the specification does not assert or demonstrate any specific function for the polypeptide of SEQ ID NO:2. It further alleges that the genus as claimed recites no particular nucleotide sequence and no particular function for the isolated nucleic acid molecule or the polypeptide it encodes. The Office Action further alleges that Applicant is not in possession of all genes or a representative number of genes located on chromosome 1, including allelic variants and natural mutants that have the recited function. The structure of such genes, it is alleged, is not predictable based upon the disclosure of SEQ ID NO:1 or SEQ ID NO:4.

Claim 1, as amended, is directed to isolated nucleic acids comprising a sequence of a gene located on *Arabidopsis thaliana* chromosome 1, the disruption of said gene resulting in a phenotype of abnormal homologous chromosome attachment during the meiotic prophase I. Claims 2 and 3 are further directed to such isolated nucleic acids wherein the nucleic acid encodes a cyclin domain; and wherein the gene comprises exons that form an open reading frame having a sequence which encodes a polypeptide approximately 578 amino acids in length, respectively. Claim 4 is directed to a cDNA molecule comprising the exons that form an open reading frame having a sequence which encodes a polypeptide approximately 578 amino acids in

length. The specification describes these nucleic acids in terms which are adequate to allow one of skill in the art to distinguish them from other isolated nucleic acids.

In accordance with the opinion of the Amgen court, the claims in question, while not describing the precise sequence of the isolated nucleic acid, do adequately describe the molecules with respect to the functional properties which in the knowledge of the art, particularly including the contribution of the instant specification to the knowledge of the art, are known to be sufficiently correlated with the sequences covered by the claims. For example, the specification provides functional description of the pertinent gene as a "regulator of meiosis." (Applicant's Specification, page 8, lines 16); and "a meiosis-specific cyclin that activates a cyclin-dependent kinase (CDK) to regulate activities of other proteins that maintain homolog attachment." *Id.* at 28-30. The sequence is described from biochemical perspective. For example, the sequence is stated to encode a cyclin like domain with 28-34% amino acid identity to plant type A and B cyclins and 21% identity to an *Arabidopsis thaliana* type D cyclin. *Id.* at 20-22. The description also makes it clear that the sequence comprises the sequence of the SDS gene, and describes its location on the *Arabidopsis thaliana* chromosome, as well as multiple phenotypic characteristics of the gene. For example, the disruption of the gene results in abnormal homolog attachment. *Id.* at page 9, line 6. The gene is not expressed during vegetative development, nor during late flower development, nor in fruit or seed development. *Id.* at 2-3. Results indicate that the gene is in fact, meiosis-specific and encodes a novel type of cyclin. *Id.* at 5. the gene is further phenotypically characterized with respect to its function during male meiosis (reduced number and size of pollen grains, with different size and number of microspores). Light microscopy was combined with chromosome spreading and DAPI staining during various phases of meiosis, e.g. leptotene, late zygotene or early pachytene, pachytene, diplotene, diakinesis, prophase I, metaphase I, anaphase I, telophase I, meiosis II, prophase II, anaphase II, telophase II, and metaphase II. Meiotic spindles were studied and compared in wild-type and mutant *sds* cells by immunofluorescence microscopy. The phenotypic characteristics for both the light and immuno-fluorescence microscopy results are detailed in the specification on pages 9-11. The specification also describes the phenotype of no seed production under constant light conditions and minimal seed production under

greenhouse conditions. The progeny of the plants were also seedless. Id. at page 12, line1-16.

Additional functional information is provided which would assist the skilled artisan in identifying that the Applicant has invented the claimed nucleic acid and had possession of the same at the time of filing. A DNA sequence for a representative gene is provided in the sequence listing. Working examples demonstrate isolation of a representative gene and creation of a representative variant or mutant of the gene. While the exact sequence of the nucleic acid is capable of certain variation, this is exactly what is described and claimed. One of skill in the art would be able to distinguish exactly the genus of sequences which are covered by the claims in question. The fact that a certain amount of variation is present or that naturally occurring allelic mutant exist would not be unexpected by the skilled artisan. Those of skill understand and expect that nucleic acid sequences can vary by as much as 33%, e.g. from species to species, based on the degenerative nature of the code, and still encode the exact same function. In addition, the known evolutionary compatability of conservative amino acid substitutions provides for additional degrees of *expected variation* by those of skill. Thus, the combination of the sequence information provided, the biochemical functions, and the extensive phenotype characterization provided make the structure of the claimed molecules clear to those of skill in the art, notwithstanding the limitations of language.

Significantly, the disclosure provided would tend to render the claimed isolated nucleic acid obvious. Such a disclosure, as a matter of law, is sufficient to meet the written description requirement of 35 U.S.C. §112. Neither is the policy purpose of the written description frustrated by this specification; the public is put on sufficient notice of what the inventor has invented and claimed. *See* Written Description Guidelines. The functional description is adequate in combination with the sequence disclosed and the ample disclosure of phenotypic characteristics allow the skilled artisan to immediately understand that which Applicant claims as his own. The fact that Applicant seeks protection of the claimed genus would not prevent the inventor who discovers a particular species with unique or unexpected properties from equally obtaining protection for his own discovery. Based on the foregoing, Applicant asserts that the Office Action has failed to assert why the skilled artisan

would not recognize the invention as claimed; and further asserts that there more than adequate description to render the structure known to the skilled practitioners in biotechnology. Applicant respectfully requests reconsideration and withdrawal of the rejection with respect to claims 1-4.

With respect to claims 9, and 12-13, Applicant respectfully traverses the rejection, as the Office Action fails to clearly set forth sufficient evidence, on a reasonable basis, as to why the strong presumption of adequacy is overcome and the requirements of 35 U.S.C. §112, first paragraph, are not met. The Office Action simply offers nothing with respect to these claims to meet its burden. Further, the facts here are similar to those of Amgen, where the adequacy the written description with respect to mammalian and vertebrate cells was challenged. In finding the written description to be adequate with respect to the challenged claims, the Amgen court emphasized “the words ‘mammalian’ and ‘vertebrate’ readily ‘convey distinguishing information concerning their identity’ such that one of ordinary skill in the art could ‘visualize or recognize the identity of the members of the genus.’” Here, the words “vector” and “transformed plant cell” likewise convey adequate distinguishing information to those of skill in the art. That is all that is required by the statute. Further, here ample additional description is provided as to use of vectors, methods of transforming plants and properties of the plants so transformed. Accordingly, Applicant request reconsideration and withdrawal of the rejection with respect to claims 9, and 12-13.

The Requirements of 35 U.S.C. §112, First Paragraph for Enablement are Satisfied for Claims 1-9, 12-14 and 17-18.

Claims 1-9, 12-14 and 17-18 stand rejected under 35 U.S.C. §112, first paragraph because the specification allegedly does not enable one of skill in the art to make and use the invention. The Office Action asserts that one of skill in the art would not be able to practice the invention without undue experimentation. The Office Action does not acknowledge any scope of enablement. Applicant respectfully traverses this rejection.

The question of enablement is a question of law, based on underlying factual determination. Amgen, Inc. v. Hoechst Marion Roussel, Inc. et al., No. 01-1191, 01-1218, 2003 U.S. App. LEXIS 118 at *48 (Fed. Cir. 2003). Before any analysis of enablement can occur, it is necessary for the examiner to construe the claims. The examiner should always look for enabled, allowable subject matter and communicate to applicants what that subject matter is at the earliest point possible in the prosecution of the application. (MPEP 2164.04). Further, the examiner bears the burden of establishing a reasonable basis to question the enablement of the claims in question. In re Wright, 27 U.S.P.Q.2d 1510, 1513 (Fed. Cir. 1993). The burden then shifts to the applicant to provide persuasive evidence that one skilled in the art would be able to make and use the claimed invention using the application as a guide. In re Branstadter, 179 U.S.P.Q. 286, 294 (C.C.P.A. 1973).

The Federal Circuit has consistently held that "the specification must teach those of ordinary skill in the art how to make and use the full scope of **the invention** without undue experimentation. In re Wright, 999 F.2d 1557, 1561 (Fed. Cir. 1993). Since the invention is obviously that for which patent protection is sought, "the claims must be analyzed first in order to determine exactly what subject matter they encompass." In re Angstadt, 537 F.2d 498, 501 (CCPA 1976). The subject matter there set out must be presumed, in the absence of evidence to the contrary, to be that "which the applicant regards as his invention." Full effect must be given to all claim limitations. Id.

The fact that a quantity of experimentation, even complex experimentation, may be required is not dispositive of the analysis (MPEP 2164.04). The key word is "undue," not "experimentation". Angstadt, 537 F.2d at 504. The factors to be considered in determining whether experimentation is undue include the breadth of the claims; the nature of the invention; the state of the prior art; the level of one of ordinary skill; the level of predictability in the art; the amount of direction provided by the inventor; the existence of working examples; and the quantity of experimentation needed to make or use the invention based on the content of the disclosure. In re Wands, 858 F.2d 731, 737 (Fed. Cir. 1988).

Nevertheless, not everything necessary to practice the invention need be disclosed. The Federal Circuit has stated that what is well-known is best omitted. In re Buchner, 929 F.2d 660, 661 (Fed. Cir. 1991). Further, the scope of enablement must only bear a reasonable connection to the scope of the claims. See, e.g., In re Fisher, 427 F.2d 833, 839 (CCPA 1970). Additionally the as the Federal Circuit recently reiterated, the law is clear that the specification need teach only one mode of making and using a claimed invention. Amgen, 2003 U.S. App. LEXIS 118 at *50.

A. The Claims Are Fully Enabled By The Specification .

The Office Action alleges that claims 1-9, 12-14 and 17-19 contain subject matter which was not described in the specification in such a way as to enable one skilled in the art to make and use the invention. In particular, the Office Action alleges that the claims recite "no particular function" for the isolated nucleic acid or the polypeptide it encodes. Furthermore, the Office Action states the specification does not assert or demonstrate any specific function for SEQ ID NOS:1 or 2, and that recitation that the disruption of the gene from which a nucleic acid molecule is isolated, is associated with failure to maintain homolog attachment during meiotic prophase I is not a recitation of a particular function for the nucleic acid or the polypeptide it encodes. The Office Action concludes that absent a known of recited function, undue experimentation would be required of one skilled in the art in order to make and use the invention, as there would be no way to eliminate the enormous number of inoperable embodiments on the basis of function. If inoperable embodiments can not be eliminated other than by trial and error, an invitation to experiment is provided.

As a threshold matter, Applicant asserts that the functions of the gene and the encoded polypeptide are described throughout the specification. Additionally Applicants disagree that the particular function of a gene cannot be determined by the disruption of a gene and observation of lost functions. In fact, much of biotechnology has developed through the use of such technology. Many genes and their functions have been discovered, for example through the use of knock-out mutants and rescue mutants, and this approach is well-known to those of skill in the art and of benefit to all. It is a viable and art-recognized means of determining gene function.

Here, however, Applicant has gone much further than simply identifying the knocked-out function in characterizing the properties of the underlying gene. The gene in question, the SDS gene, encodes a meiosis-specific cyclin that activates a cyclin-dependent kinase to regulate the activities of other proteins that maintain homolog attachment. Applicant's Specification at page 8, lines 28-30. The SDS gene function in maintaining normal homologous chromosome attachment has been clearly established in the instant specification. The gene was initially characterized by the effects of its disruption. Upon sequencing cloning and sequencing the gene, the function was confirmed by comparing its encoded protein with other known proteins with related functions. The specification informs one of skill that the gene encodes a protein with strong similarity to known cyclins. The cyclin domain has about 28-34% amino acid identity to plant type A and B cyclins and 21% identity to an *Arabidopsis thaliana* type D cyclin. Applicant's Specification, page 8, lines 20-22. Cyclins are also known to be central regulators of the mitotic cycle and are known to regulate mitotic sister chromatid separation at anaphase. Id. at lines 24-25. It is also likely that cyclin and CDK are critical regulars of homolog attachment in meiosis I. Thus, the specification teaches that the SDS gene encodes a meiosis-specific cyclin that activates a cyclin-dependent kinase to regulate the activities of other proteins that maintain homolog attachment. Id. at lines 28-30.

The specification also states that there is evidence that SDS interacts with ASK1 and SYN1 genes, which are also involved in the regulation of meiosis. Id. at lines 30-31. Further, SDS appears to be a meiosis-specific gene. Id. at page 9, line 5. In terms of specific functions, it is clear from the specification that, in addition to its role in regulating normal homolog attachment, the SDS gene also regulates male meiosis in a recessive manner (Id. at lines 6-7); and also regulates female meiosis to some extent. Id. at page 12, lines 13-16. As a corollary to these roles, SDS plays a role in pollen production and seed production. Id. at pages 9 and 12.

While the limits of language make it difficult to describe the characteristics of meiotic regulation which have not previously been described, this in no minimizes the function of the inventor's discovery. Those of skill in the art, armed with the detailed description of the location of the gene, the sequence of the gene and the biochemical

and phenotypic descriptions of the wild-type and the mutant would be able to make and use the claimed invention with out undue experimentation. A more precise description of the function is not required under the statute where, as here, one of skill in the art can make and use the invention having the inventors specification and the prior art before them.

The working examples teach how to isolate the SDS gene and how to identify *sds* mutants. A variety of well-known methods are suggested for obtaining the desired nucleic acids and proteins. The specification teaches how to obtain the mutants from both high and low ploidy number plants. Examples of simple methods include screening for: reduced number of abnormal pollen grains with variable sizes; microsphere having different sizes in the anther; and "tetrads" with four to six or eight microspheres having variable sizes. Confirmation of the genotype after the simple screen would be by well-known molecular methods. Probes can be readily be prepared from the sequences provided. Alternatively, nucleic acid libraries can be screened by well-known techniques using the sequences provided. This experimentation would all be considered routine by today's standard in light of the state of the art and the high level of skill of those involved.

Likewise eliminating allegedly inoperative embodiments would also be routine, based on the information provided in the specification. Even though inoperable or unsuccessful embodiments are not fatal, the methods taught need not lead to 100% success. Applicant asserts that every screening or selection method in biotechnology results in the elimination of thousands, if not millions, of "failed attempts," "unsuccessful experiments," and "inoperable embodiments", and thus the power of screening and selection methods. In Wands, the claims were held enabled based on 4 successful tests out of over 143 experiments where no successful embodiments were found.

In sum, with respect to the rejection for the lack of enablement, the Office Action does not establish any grounds to support the contention that undue experimentation would be required, or that insufficient guidance is provided to enable those of skill in the art to make and use the invention as claimed, other than that

allegedly no function is disclosed for the SDS gene and for the protein, and that without undue experimentation, inoperable embodiments could not be eliminated by those of skill attempting to make and use the invention. As explained above, the function of the gene comprised by the claimed nucleic acid has been adequately described in the specification and the alleged problem of inoperable embodiments does not require undue experimentation. For the foregoing reasons, the Applicant asserts that the claims, as amended, are fully enabled according to 35 U.S.C. §112 and that no undue experimentation is required for a skilled artisan to practice any of the claims. Accordingly, Applicant respectfully requests withdrawal of the rejection for lack of enablement under 35 U.S.C. §112, first paragraph.

The Claimed Invention has a Well-Established Utility

Claims 1-9, 12-14 and 17-19 were deemed to lack either a specific and substantial asserted utility or a well-established utility. The Office Action alleges first that the claims do not recite a specific function for the nucleic acid of SEQ ID NO:1 or for the polypeptide of SEQ ID NO:2 or for the sequences having per cent identities to them, or hybridizing to SEQ ID NO:1. Again the Office Action alleges that reciting the results of disrupting the gene is not a specific function because other genes when disrupted may have that function; and this does explain what the polypeptide of SEQ ID NO:2 "does."

The Office Action also alleges that the claimed invention lacks utility because no function has been demonstrated for the nucleic acid of SEQ ID NO:1 or the polypeptide of SEQ ID NO:2. The Office Action states that no empirical data is presented, and although empirical data is not required, amino acid homology does not replace empirical data for confirming function.

Finally the Office Action alleges that the claimed nucleic acid sequences lack substantial utility under current utility guidelines because the specification does not disclose how to use the claimed nucleic acids to manipulate or regulate any aspect of fertility in a plant, and does not teach how the claimed sequences would be

substantially beneficial to the public. The Office Action states that is not refined to the point where specific benefit exists in currently available form.

In contrast to these allegations, the Applicant asserts that the invention has a well-established utility which would be recognized by one of skill in the art. At page 9, lines 21-23, the specification teaches that "as pollen is allergenic to humans and other organisms, plants mutant in SDS and therefore having a defective pollen and male sterility could be extremely beneficial to the public." The specification also teaches that "transgenic plants that exhibit one or more of the aforementioned desirable phenotypes can be used for plant breeding, or directly in agricultural or horticultural applications." Id. at page 23, lines 3-5. And "[f]urther, plants could be generated which are SDS deficient, resulting in failure to produce pollen and/or sterility. Id. at lines 7-8.

Those of skill in the art would immediately understand, in view of the teachings of the specification, and the properties of the sds gene, how to make such plants and how to benefit from them. This utility making male sterile or pollen deficient plants is well established in the art of plant breeding, particularly with respect to hybrid plants and the desire to minimize cross pollination.

Likewise, the specification identifies well-established utility for the nucleic acids and proteins of the invention for plant breeding purposes. The specification notes that sds mutant plants are typically male sterile and are valuable for generation of hybrid seed and hybrid plant varieties. They are useful for containment purposes in cross-breeding. Commercial and practical benefits of sds mutant varieties of flowering trees and shrubs are taught and the utility in maximizing flowers with no pollen is presented.

Again, those of skill in the art would recognize these utilities as well-established. The invention provides such utilities for the plants, nucleic acids and proteins of the invention.

The Office Action also alleges that no empirical data are provided to support the role of SDS as a cyclin. Applicant notes that there are extensive data comparing

mutant and wild-type cells and chromosomes throughout the meiotic cycle. These data obtained through both light and immunofluorescent microscopy clearly establish the role of SDS as a regulator of meiosis. Applicants Specification, pages 9-12. The Northern analysis confirms that the protein is expressed in a meiosis-specific manner; expression is both spatially and temporally controlled in the male, and is restricted to microsphere mother cells within the anther. *Id.* at 30. Additionally the data on revertants established the regulatory role of SDS in meiosis, since the revertant sequences did not disrupt gene function, restored wild-type function, and could not have been from wild-type copies. *Id.* at 29. While Applicant bears no burden to provide such data, especially where, as here, the relationship between the structure and function is abundantly clear from an unusually wide variety of data; the homology data further strongly support the identification as a putative cyclin.

Applicant asserts that multiple well-established utilities have been set forth in the specification and that specific function has been provided for the sds gene and its protein. The utilities provided are more than sufficient to meet the requirements of 35 U.S.C. §101. This is supported by the Utility Examination Guidelines and is consistent with UPTO policy. In view of the foregoing, Applicant requests that the rejection under 35 U.S.C. §101 is moot and respectfully requests its withdrawal.

Claim 14, As Amended, Satisfies the Requirements of 35 U.S.C. §102(b).

Claim 14 was rejected as being anticipated by Bohmert *et al.* (EMBO J. 17: 170-180, 1998). Bohmert *et al.* teach an isolated nucleic acid molecule which contains the open reading frame of the AGO1 gene located on *Arabidopsis thaliana* chromosome 1. The Office Action states that the nucleic acid of Bohmert *et al.* would necessarily hybridize to the nucleic acid of claim 14 (f) because 14(f) does not limit the size of the sequence that would hybridize with SEQ ID NO:1. Claim 14, as amended is directed to a nucleic acid consisting essentially of the sequence of an open reading frame from *Arabidopsis* chromosome 1, the open reading frame have a sequence selected from: (f) a nucleotide sequence that hybridizes to SEQ ID NO:1 under stringent conditions. There is no teaching in Bohmert *et al.* of a sequence

which would hybridize with SEQ ID NO:1 at all. More particularly, Bohmert *et al.* teach a nucleic acid which maps between RFLP markers GAPB and m213 at map positions 105.5 and 129.3 cM respectively. The Applicant claims a nucleic acid which hybridizes under stringent conditions to SEQ ID NO:1, which corresponds to a sequence which maps on chromosome 1 at about 23.6 cM. It is not necessarily so that the nucleic acid of Bohert *et al.* would hybridize to the claimed nucleic acid at all, and even less likely that it would hybridize to claimed nucleic acid under stringent conditions. Since Bohert *et al.* do not explicitly teach all the limitations of the claim and the limitations of the claimed nucleic acid are not inherent in the nucleic acid taught by Bohert *et al.*, the rejection is no longer proper and should be withdrawn. Accordingly, Applicant respectfully requests withdrawal of the rejection under 35 U.S.C. §102(b).

Summary

In view of the foregoing amendments and remarks, Applicants assert that this application is in condition for allowance and respectfully request early and favorable notification to that effect. If it would expedite prosecution of this application, the Examiner is invited to confer with applicants' undersigned representative.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned **"Version with markings to show changes made."**

Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW CHANGES MADE**IN THE CLAIMS:**

Please cancel claim 9.

Please amend the claims as follows:

1. (Amended) An isolated nucleic acid molecule, comprising a sequence of a gene located on *Arabidopsis thaliana* chromosome 1, the disruption of ~~which is said~~ gene resulting in a phenotype of associated with a failure to maintain abnormal ~~homolog~~ homologous chromosome attachment during the meiotic prophase I.
3. (Amended) The nucleic acid molecule of claim 2, wherein the gene ~~is composed of~~ comprises one or more exons that form an open reading frame having a sequence that encodes a polypeptide approximately 578 amino acids in length.
5. (Amended) The nucleic acid molecule of claim 3, wherein the open reading frame ~~encodes~~ comprises a sequence encoding an amino acid sequence at least 70% identical to ~~the~~ a cyclin domain comprising amino acids 361 through 521 of SEQ ID NO:2.
8. (Amended) The nucleic acid molecule of claim 6, which comprises an open reading frame having the sequence ~~set forth in~~ of the one or more exons of SEQ ID NO:1.
14. (Amended) An isolated nucleic acid molecule ~~comprising~~ consisting essentially of the sequence of an open reading frame of a gene located on *Arabidopsis* chromosome 1, the open reading frame having a sequence selected from the group consisting of:
 - a) a sequence comprising the exons of SEQ ID NO:1;
 - b) a sequence that is at least 80% identical to the exons of SEQ ID NO:1;
 - c) a sequence encoding a polypeptide having SEQ ID NO:2;
 - d) a sequence encoding a polypeptide having a at least 50% identity to SEQ ID NO:2;

- e) a sequence encoding a polypeptide comprising a cyclin domain having at least 70% identity to the cyclin domain comprising amino acids 361 through 521 of SEQ ID NO:2; and
- f) a nucleotide sequence that hybridizes with SEQ ID NO:1 under stringent conditions, wherein stringent conditions are hybridizing for at least 6 hours at 37°C in 5X SSC, 5X Denhardt's reagent, 1.0% SDS, 100 µg/ml denatured fragmented salmon sperm DNA, 0.05% sodium pyrophosphate; and washing once for 5 minutes at room temperature in 2X SSC and 1% SDS, once for 15 minutes at room temperature in 2X SSC and 0.1% SDS, once for 30 minutes at 37°C in 1X SSC and 1% SDS and four times for 30 minutes each at 42°C in 1X SSC and 1% SDS.